

PhD position available

Multifunctionality of Ecosystems Services delivered by Aboveground-Belowground Interactions in the Neotropics

Starting date: October 2024

Fully funded PhD position available at iEES-Paris, starting in October 2024. Field work is in the region of São Paulo, Brazil.

Neotropical regions are biodiversity hotspots¹ and play a key role in earth functioning at both regional and global scales, as exemplified by the role of the Amazon forest in climate² and carbon cycling³. Ecosystem functioning in these regions highly depends on its biodiversity and easily engage in catastrophic shifts when its components are affected⁴. Whereas the role of vegetation from the Neotropics in climate regulation and multiple other ecosystem services is largely acknowledged, the contribution of the soils and their biodiversity to ecosystem services is still largely overlooked⁵. Though, its contribution is likely to be major, through at least three key overlooked mechanisms that the PhD candidate will study:

The PhD candidate will start by exploring the **links between soil food web structure and carbon fluxes** in the brown and green foodwebs, along a gradient of land use intensification. To do so, he/she will apply food web theory on the MACROFAUNA⁶ database, which is curated by the Mentors of the project. This approach will allow him/her to estimate the amount of carbon that is processed by soil macrofauna, based on their abundance, body size and ambient temperature, in different land cover types. The database is already ready to use, and several R packages are available to compute the fluxes. This part of the work will be done in collaboration with Elisa Thebault and Zoe Lindo, both specialist of foodwebs.

The second axis of his PhD will focus on the **above ground-belowground links**. The candidate will sample soil macrofauna in different soil types along a gradient of land use intensification (Native vegetation vs pasture and monoculture crop) within permanent plots maintained by the University of São Paulo and collaborators of M. Cooper, the Brazilian PI. The candidate will identify taxa that are above ground pollinators or herbivores. Many species in the soil are actually aboveground during their life. For instance, many hymenoptera and diptera are pollinators during the adult stage, but live in the soil during their larvae stage. Using existing database of plant pollinators and herbivores, he/she will be able to identify these species, and to link them with their host plant. This will allow him/her to show how the structure of this multi-layer network varies with land use intensification and soil type.

The third axis of the PhD will be on the **effect of soil ecosystem engineers on soil biodiversity**. To study this, the candidate will sample soil fauna in the biostructures produced by the ecosystem engineers (EE), such as earthworm cast, ants' and termites' nests and compare it to soil fauna outside these structures. He/She will also sample compare eDNA within and outside biostructures. This will allow him/her to identify soil species that inhabit biostructures and to use these pairwise interactions to build bipartite networks. Based on this network, he will be able to calculate the degree of specificity of the interactions, and see how land use intensification impacts the diversity of pollinators and herbivores that live in the soil.

Candidate's profile

We are looking for a highly motivated candidate who is willing to approach the three questions mentioned above. The candidate must have a high level of autonomy and capacity to adapt to new environments, in particular regarding the field work abroad. An experience in identification of invertebrates by molecular barcoding and/or by morphological approach would be greatly appreciated. The candidate must also have good communication skills, as its work will be part of a larger project involving other PhD students and collaborators from France, Brazil and other countries.

Working context

The PhD is funded for three years by the CNRS and the University of São Paulo, starting October 2024. It will be jointly developed with a Brazilian PhD funded over the same period of time, who will focus on the soil ecosystems services in the same studied plots. The work of the two PhDs will be complementary and we expect a high level of synergy between the two candidates. The PhD will be supervised by Jerome Mathieu in France and co supervised by George Brown and Miguel Cooper in Brazil. The eDNA component of the project will be mentored by Lucie Zinger (in Brazil). The candidate will have the opportunity to participate to workshops and take part of the dynamics of the #GlobalSoilMacrofauna consortium(6) (<https://www.globalsoilmacrofauna.com/>), and FaunaServices (<https://www.fondationbiodiversite.fr/la-frb-en-action/programmes-et-projets/le-cesab/faunaservice/>) led by the PIs. This will provide him/her a unique opportunity to develop its own international collaboration network, and participate to several other work packages.

The position includes field and lab work in Brazil for at least 3 months the first two years. The candidate will receive a full training in molecular identification and food web fluxes calculation in France. The candidate will be hosted in Sorbonne University in the Institute of Ecology and Environmental Science, in the team Ecology and Evolution of Interactions Networks.

Application procedure

The candidates should send a CV, a letter of motivation, an example of a previous report, and if possible one or more recommendation letters. We intend to proceed to the interviews during the last week of June or first week of July 2024.

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